A DISTRIBUTIONAL AND VARIATIONAL STUDY OF THE ADULT AMPHIBIANS OF ILLINOIS

BY

PHILIP WAYNE SMITH

B.S., University of Illinois, 1948
M.S., University of Illinois, 1949

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ZOOLOGY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1953

URBANA, ILLINOIS

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To Dr. Hobart M. Smith, my major professor, I am immeasurably indebted for suggestions, inspiration, and a guiding hand throughout the past five years. Dr. Herbert H. Ross, who has supervised this project, has taken a keen interest in its progress and has provided almost every necessity in building up a reference collection. Dr. Howard K. Gloyd, who relinquished his priority in this problem, has saved hours of labor by actually commencing the cataloging of the Natural History Survey specimens and the canvassing of the larger museums for their Illinois records.

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Emphasis has been placed on distribution and variation of the amphibians of Illinois. The introductory sections include a description of the scope and aims of the study, a glossary of the characters studied, a list of the criteria found useful in distribution analyses, a brief description of the physical, climatic, and biotic features of the state, an annotated list of the herpetofaunal divisions and their characteristic species, a list of species deleted from the Illinois fauna, a list of species hypothetically occurring in the state, a synopsis of the amphibians of Illinois, and keys for the identification of the adult stages.

The species accounts include a complete list of bibliographic references to Illinois, a brief diagnosis, an account of the Illinois distribution, descriptions of sexual, ontogenetic, and geographic or individual variation, a list of locality records, a distribution map for each species, and in some cases remarks concerning the taxonomy of the species or subspecies.

Three subspecies (*Bufo americanus* subsp., dwarf form; *Hyla versicolor chrysocelis;* and *Rana clamitans clamitans*) are first reported for Illinois herein. The reported occurrence of two subspecies (*Rana pipiens sphenocephala* and *Rana sylvatica cantabrigensis*), heretofore regarded as doubtful in Illinois, has been substantiated. Nomenclatorial changes resulting from this study are: *Bufo terrestris americanus auct.* equals two races here allocated to *Bufo americanus* subspecies, large form and dwarf form; *Acris gryllus blanchardi auct.* equals *Acris crepitans blanchardi; Hyla phaeocrypta phaeocrypta auct.* equals *Hyla avivoca avivoca; Rana pipiens pipiens auct.* equals *Rana pipiens brachycephala;* and *Eurycea longicauda pernix auct.* equals *Eurycea longicauda longicauda.*

New distributional data are added for all the 42 species and subspecies, and correlations of distribution and environ-

mental factors have been pointed out for most of the Illinois forms. The study of variation has resulted in the discerning of additional diagnostic characters for at least ten species, new secondary sexual characters for three species, possibly new features illustrating ontogenetic variation in sixteen species, clinal variation in eleven forms, recognizable subraces in three species, and one hybrid population.

The attempted analysis of the total herpetofauna has revealed that the major events responsible for the present amphibian distribution in Illinois are:

1) The Wisconsin glacial period at which time Illinois was probably completely devoid of amphibians and reptiles;

2) ? The warm, dry pine phase;

3) The beginning of the Climatic Optimum and the Oak-elm phase;

4) The xerothermic period and eastward extension of prairie;

5) The return of a cooler, moister, climate and its characteristic vegetation;

6) The cultivation of land and related human disturbances.

Analyzing the present distribution, 32 per cent of the amphibians may be regarded as eastern, 22 per cent as southern, 12 per cent as northern, 12 per cent as western, and 22 per cent as unclassified. The composition of the fauna prior to the beginning of the Climatic Optimum can only be surmised, and actual evidence is completely lacking. During the warm oak-elm phase, however, it can be inferred that southern animals occurred further north than at present. These species still a part of the Illinois fauna are:

Ambystoma talpoideum
Hyla avivoca avivoca
Scaphiopus holbrookii holbrookii
Microhyla carolinensis carolinensis.
Hyla cinerea cinerea
Rana clamitans clamitans

In addition, most of the eastern elements probably occurred within what is now Illinois. Western elements were probably lacking; the presence of northern animals is uncertain. With the eastward advance of prairie, spear-headed by oak-hickory forest, amphibians of mesic woodlands probably shrank either to the north or south or persisted in small relicts which afforded some protection. Western animals were provided with an avenue for eastward dispersal. These species seem to be:

Ambystoma texanum
Pseudacris nigrita triseriata
Pseudacris streckeri illinoensis
Rana areolata circulosa.

The return of a cooler, moister climate and the partial replacement of prairie and oak-hickory forest by more mesic woodlands, beech and maple in the south and conifers and *Tilia* in the north, can be envisioned by studying the amphibian distributional patterns. From the north the following species appear to have re-entered Illinois varying distances:

Ambystoma jeffersonianum
Hemidactylium scutatum
Rana sylvatica cantabrigensis.
Rana pipiens brachycephala

Bufo americanus subsp., large form

From the east and southeast the following species seem to have dispersed varying distances westward:

Ambystoma maculatum
Ambystoma opacum
Desmognathus fuscus fuscus
Plethodon cinereus cinereus
Cryptobranchus alleganiensis
Eurycea longicauda longicauda
Plethodon glutinosus glutinosus
Scaphiopus holbrookii holbrookii
Plethodon dorsalis
Pseudacris nigrita feriarum
Rana clamitans melanota
Rana palustris

Simultaneously, the typically western species were subjected to adverse climatic and vegetational changes. The

ranges of species with little tolerance were probably reduced to relicts where the original habitat is approximated (e.g. *Pseudacris streckeri illinoensis*). The more adaptable species as *Pseudacris nigrita triseriata* maintain themselves in the reduced prairies and even in agricultural areas.

The human disturbance within historic times is mainfested in the shrinking natural ranges of the following species:

Siren intermedia nettingi
Hyla crucifer crucifer
Notophthalmus viridescens louisianensis
Rana sylvatica cantabrigensis
Rana sylvatica sylvatica.

VITA

Philip Wayne Smith, born December 2, 1921, at Neoga, Illinois, attended grammar school in several central Illinois communities and high school in Greenup, Illinois. He attended Eastern Illinois State College from 1940 through 1942 and worked half-time as resident biologist at the Natural History Survey Limnological Laboratory at Fox Ridge State Park through 1942. After three years in the army, he reentered Eastern Illinois State College for a year, transferring to the University of Illinois in 1947. He received the B.S. degree in February, 1948, and the M.S. in September, 1949. Since June, 1947, he has been with the Natural History Survey, serving as curator of the non-insect faunistic collections.

He is a member of the American Society of Ichthyologists and Herpetologists, Chicago Academy of Sciences, Ecological Society of America, Herpetologists' League, Illinois Academy of Sciences, Phi Sigma, Sigma Xi, and the Society of Systematic Zoology. He is author or co-author of the following articles: "The reptiles and amphibians of eastern central Illinois," "A cestode infestation in Typhlotriton," "Food habits of cave dwelling amphibians." "Noteworthy herpetological records from Illinois," "Notable records of reptiles and amphibians in Oklahoma, Arkansas, and Texas," "Handbook of frogs and toads (Review)," "Additional noteworthy herpetological records for Illinois," "*Thecadactylus rapicaudus* in Honduras," "Herpetological results of the University of Illinois Field Expedition, Spring 1949. III. Sauria," "Mexican and Central American garter snakes (*Thamnophis*) in the British Museum (Natural History)," "A third locality for the ringed salamander, *Ambystoma annulatum*," "The coloration of the tail tip of young fer-de-lances: sexual dimorphism rather than adaptive coloration," "A new snake (Tantilla) from the Isthmus of Tehuantepec," "A new lizard (Sceloporus) from Oaxaca, Mexico," "A new frog and a new turtle from

the western Illinois sand prairies," "The marbled salamander, *Ambystoma opacum* (Gravenhorst), in Michigan," "Geographic variation in the lizard *Eumeces anthracinus*," "The relationship of the chorus frogs, Pseudacris nigrita feriarum and Pseudacris n. triseriata," "Notes on a collection of amphibians and reptiles from eastern Mexico," "Notas sobre algunos anfibios y reptiles colectados en el Estado de Chiapas," "A new toad from the highlands of Guatemala and Chiapas," and "Results of a herpetological collection from eastern central Mexico."